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ABSTRACT

This is one of five volumes prepared to describe various aspects of the Del Mod System. This report attempts to compare baseline data gathered in 1970-71 to post experimental data gathered in 1975-76. Sections include analyses of achievement test scores, research conducted under the auspices of the Del Mod System, and a follow-up study of teachers' perceptions. Achievement test data analyzed (for a small sample of students) show gains for most samples of students. Forty-four teachers who had been involved with the Del Mod System over a five year period of time provided their perceptions of various elements of the program, what aspects should be retained, strengths of the program, and how the program could be improved. Evaluations are generally positive; the field agent concept in particular was strongly supported. (RH)

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1971-1976

STATE OF DELAWARE

Statistical Comparisons of Pre and Post Del Mod Data

John R. Bolig
Charles Wall

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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FINAL REPORT

VOLUME V

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STATISTICAL COMPARISONS OF

PRE AND POST DEL MOD DATA

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FOREWORD

This is one of five volumes which were prepared to describe various aspects of the Del Mod System. The other volumes give an overview of the System, a description of two aspects of the program; its field agents and its resource centers, and an external evaluation of Del Mod.

The intention of the authors of this report was to compare baseline data gathered in 1970-1971 to post experimental data gathered in 1975-1976. A number of factors prohibited us from completing the job we set out to do, and some of the comparisons which are still possible will have to be done at some later date. Post testing, for example, was not properly conducted and the results were delivered almost two months late.

To our amazement, the comparisons which were possible were totally unexpected. Gains were made in almost all of the achievement test scores. The statistical comparisons, unfortunately, were inhibited by the violations made in the data collection conducted by one of the Del Mod components. We have made no effort to conceal our disappointment about the poor cooperation we received in this effort. If the System had functioned properly, this would have been a much better report.

Chapter One

STATISTICAL COMPARISONS

John R. Bolig
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STATISTICAL COMPARISONS

CHAPTER ONE

INTRODUCTION

In the year prior to the creation of the Del Mod System, several types of data were collected to be used as benchmarks by which the progress of the System could be measured. Among these data were tests of student achievement at the fourth, eighth, tenth, and twelfth grade levels.

Various types of teacher data were also gathered, and these have had a rather unfortunate history during the course of Del Mod's existence.

Post Del Mod comparisons on student and teacher types of data are reported in this paper in those instances where appropriate and reasonably comprehensive comparisons could be made. Despite the intervention of several restrictive factors concerning data collection, Del Mod is able to make some interesting and worthwhile comparisons.

Student Data. Testing students is a mandated prerogative of Delaware's Department of Public Instruction. The Delaware legislature provides the necessary funds for this activity, and Delaware school districts comply with the test program even though compliance is voluntary.

For Del Mod to test students, or to influence the DPI's testing of students, it was necessary for these activities to be cleared via the channels of communication available to the System. A number of problems arose and not all of these were satisfactorily resolved to Del Mod's satisfaction.

Statewide achievement testing, the Delaware Educational Assessment Program, began in 1972, and was only carried out in three grades: one, four, and eight. Only in grades four and eight was science assessed. Del Mod requested input into item selection on these two tests and succeeded in increasing the length of each. The resulting items were far from ideal, but they could be used to serve as benchmarks.

Del Mod's objection to the fifty items on the grade four and grade eight tests stemmed from the observation that all 100 items were sold to Delaware by Educational Testing Service of Princeton, New Jersey. The items were advertised to be appropriate for measuring Delaware students in relation to the curricula to which they were exposed. In fact, all of the items were taken verbatim from an obsolescent test called the Sequential Test of Educational Progress which had been on the

market nationally since the mid 1960s. They reflected a textbook oriented curriculum rather than the more up to date science inquiry curricula of the 1970s which Del Mod was being asked to implement in Delaware schools.

Del Mod agreed that a poor test might be better than no test at all and succumbed to the will of the DPI. Over its five year history, the test seemed to indicate that Delaware students were not progressing well on DEAP science test scores, which is logical,if the test was measuring a factual knowledge of science when students were being taught the process of science in school.

To compound the problem, the test was altered four times during the five year period and post Del Mod comparisons were thereby compromised. The results of all possible comparisons are reported in Chapter Two of this paper.

Since the testing of grades four and eight was hardly adequate for Del Mod comparisons, grades ten and twelve were also chosen for student testing. The selection of tests appropriate to these grade levels was difficult because student choice becomes a factor in high schools. Not all students elect chemistry or physics as subjects, and biology, which was required, is taught in a wide variety of ways.

Furthermore, Del Mod was required to provide the tests, the manpower, and the analysis for the tests selected for grades ten and twelve. These are costly factors.

For grade ten, the Test on Understanding Science (TOUS) was selected. This was not an entirely satisfactory choice, but was the lesser of all possible evils. The TOUS, developed by L. E. Klopfer and W. W. Cooley, is published by ETS. It purports to measure understandings of various facets of science rather than factual knowledge of science. Use of the TOUS in high schools is rare although several studies were found to support its use with people of tenth grade age levels.

In grade twelve, testing of students was accomplished with fifty items from the National Assessment of Educational Progress (NAEP), developed by the Education Commission of the States. These items were released in 1970, and Del Mod received permission to use them. Again, the test was not ideal, but it had the advantages of offering possible comparisons to nationwide standards as well as being appropriate for high school seniors at about the seventeen year old age level.

Results on the TOUS and the NAEP are also reported in Chapter Two of this paper.

Doctoral Dissertations. Del Mod was the subject of three doctoral dissertations and one master's thesis. Descriptions of these documents appear in Chapter Three. The dissertations can be found among those on file at Delaware State College in Dover and at the University of Michigan in Ann Arbor. Descriptions of each are reported in Chapter Three. Copies of the master's thesis are on file at the University of Delaware and at Delaware State College.

Follow-up of Del Mod's First Project. In 1970-1971, Del Mod conducted a pilot field agent project. Sixty five teachers at the junior high school level participated in this effort, and the direction and philosophy underlying all subsequent Del Mod activities were the result of this effort. In 1976, Charles Wall, a Del Mod Research Field Agent, gathered data about the participants of this project; their attitudes about science education and about the influence of the Del Mod System upon their careers. This report is included in Chapter Four of this paper.

Chapter Two

ANALYSIS OF ACHIEVEMENT TEST SCORES

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ANALYSIS OF ACHIEVEMENT TEST SCORES

Chapter Two

The Del Mod System gathered baseline data in 1970-1971 using achievement tests and the TOUS, which examined student understandings of the nature and process of science. Both students and teachers were assessed. Over the history of Del Mod, 1971-1976, many factors combined to alter the course of science education in America and, specifically, in Delaware.

Nationwide, science achievement scores on tests have been declining to an alarming degree. "The American student's grasp of science has decreased significantly in the past three years, according to the results of a nationwide study conducted by the Education Commission of the States' National Assessment of Educational Progress NAEP."[1] This statement has been echoed time and again in recent publications.

The existence of the Del Mod System and the support given to Del Mod by the public schools is evidence of the emphasis placed upon science in Delaware schools.

In this Chapter, the results of post tests will be compared to data collected in the baseline year for students in grades four, eight, ten, and twelve. Also, the teachers in Del Mod's earliest project were retested and these results are reported later.

The DEAP. Despite some objections to Delaware's statewide testing program which were voiced in Chapter One, this test was given to the largest samples under the best conditions of all of Del Mod's post experimental comparisons. All of Delaware's public school children in grades four and eight were tested.

In grade four, twelve of the original fifty items remained intact over the history of Del Mod, and in grade eight, eight of the items remained intact. These were the only items Del Mod used for comparison purposes, and the percentage of gains or losses in the number of children correctly responding to these items are shown in Tables 1A and 1B.

The deletion of so many items and their replacement with other items over the years was a predictable, if discouraging, result of a poorly planned enterprise. Presumably, only the most discriminating items from the original test survived. The DPI was aware of Del Mod's need for good data, but it allowed the test to be altered to the point that reliable statistical comparisons of a pre-post nature were impossible.

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1 _____ "Science Knowledge Declining in American Schools," The School Administrator, AASA, Arlington, Virginia, April, 1975, pp. 1, 4.

Table 1A. The Twelve Items of the DEAP Test Which Were Used in 1972 and 1976, and the Percentage of Gain or Loss on Each Item - Grade 4

Item Number	1972	1976	% Gain	% Loss
2	78	84	6	
4	69	78	9	
6	72	78	6	
10	50	60	10	
12	46	58	12	
15	52	55	3	
19	53	54	1	
25	39	37		2
32	39	44	5	
33	55	64	11	
40	47	51	4	
42	24	32	8	

Table 1B. The Eight Items of the DAEP Test Which Were Used in 1972 and 1976, and the Percentage of Gain or Loss on Each Item - Grade 8.

Item Number	1972	1976	% Gain	% Loss
13	69	67		2
15	69	63		6
16	57	54		3
22	53	54	1	
28	55	61	6	
29/30	73	66		7
34	52	54	2	
42	39	41	2	

Comparisons on the twelve and eight surviving items are interesting. On the fourth grade items, eleven of the twelve comparisons show improvement. In grade eight, four of the eight items show improvement.

It is only possible to conjecture on what might have been if the DEAP had been administered in a pre-post fashion and statistically treated data had been available. The indication is obvious that Delaware's children might have shown highly significant gains in science during the Del Mod tenure.

Sample sizes on the DEAP were quite large. In grade four 9885 children responded to the 1972 items, and 7532 responded to the 1976 items. In grade eight the totals were 9809 and 9152, respectively.

The NAEP. Del Mod modified, printed, administered and scored 50 items from the National Assessment of Educational Progress (NAEP) which were released in 1970. The pretest results were reported by Bolig[2]. In 1976 the test was readministered.

The pretest administration in 1971-1972 was conducted in five Delaware high schools. The schools were randomly selected on a socioeconomic basis from five categories ranging from urban to suburban to rural in nature. A total of 1187 seniors participated in the testing.

The same schools were used for the post test and random samples of seniors were used instead of entire classes. Only 220 students were tested which makes a school by school comparison tenuous, but which is a sufficient sample for pre-post comparisons on each item.

The results of the test have not been thoroughly examined but the summary of initial comparisons can be seen in Table 2. The test itself can be found in Appendix A. The item numbers in Table 2 correspond to the items on the test.

There were 50 items on the test and the net gains are extraordinary. Males gained on 35 items and lost on 11 for a net gain on 24 of the items tested. Females gained on 28 and lost on 15 for a net gain on 13 of the 50 items. Overall, a net gain was realized on 29 of the 50 items.

In terms of gain scores, males made an average gain of 1.64 correct answers, females 1.08, and overall the gain was 1.34. A mean difference this large may be statistically significant, but a total test analysis had not been completed as this report was being written.

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[2] Bolig, John R., "The Modification and Local Use of the National Assessment Test Science Items by the Del Mod System," paper presented to NARST, March 28, 1973.

Table 2. Percentages of Gain or Loss by Item by Sex on The Pre- Post Administration of Fifty National Assessment Test Items to Delaware High School Seniors 1971-1976

MALES				FEMALES				TOTAL			
	%		%		%		%		%		%
Item	Gain	Item	Loss	Item	Gain	Item	Loss	Item	Gain	Item	Loss
3	2	1	2	3	11	1	1	3	7	1	1
7	4	2	1	4	7	2	1	4	3	2	1
8	9	5	5	6	4	5	2	6	1	5	5
9	5	6	2	8	1	7	2	7	1	24	11
11	6	10	1	9	2	24	16	8	5	30	5
12	10	15	1	10	4	26	4	9	4	31	2
13	1	24	7	11	7	29	1	10	1	36	5
14	5	28	2	13	5	30	7	11	9	49	1
16	7	30	2	14	3	31	1	12	5		
17	7	34	1	15	3	34	1	13	3		
18	6	36	3	16	15	36	9	14	4		
19	9			17	14	37	5	15	1		
20	1			18	4	42	4	16	10		
21	6			19	2	43	1	17	11		
22	9			21	1	48	1	18	6		
23	3			22	1			19	6		
25	11			23	5			20	1		
26	9			25	17			21	4		
29	4			28	7			22	6		
31	8			32	10			23	4		
32	6			33	6			25	14		
33	9			35	2			26	3		
35	2			38	9			28	2		
37	6			44	6			29	2		
38	1			45	3			32	8		
39	3			47	10			33	7		
40	7			49	1			35	2		
41	3			50	4			37	1		
42	4							38	5		
43	1							39	2		
44	4							40	3		
47	5							41	2		
48	4							44	5		
49	1							45	1		
50	8							47	8		
								48	2		
								50	7		

It is safe to speculate that the gains are unusual. The recent literature in science education is filled with reports of declining test scores. The Education Commission of the States has made similar statements about NAEP items, as was previously cited in this Chapter.

The TOUS. The Test on Understanding Science (TOUS) was administered in 1971 as a pretest and in 1976 as a post test in the tenth grades of three high schools. The schools were selected on the basis of high, average and low socioeconomic status.

In the pretest year all tenth graders were tested in each school, but in the post test year for several reasons, it was decided that samples of 20 males and 20 females in each school would suffice. The State Science Supervisor was responsible for post testing.

The Supervisor was quite aware of Del Mod's testing needs and the sample size parameters, but he through carelessness compromised the post test. In two of the schools the samples returned were inadequate in terms of size and almost forty tests had to be discarded because they were not taken under proper conditions.

The comparisons which were possible are shown in Table 3. There are statistically significant gains in the scores on the TOUS, but these results must be examined on the basis of the poor control of the experiment.

Results shown in Table 3 would have been quite exciting if the testing had been properly conducted. The TOUS is an instrument which measures people's perceptions of science. In effect, it measures an attitude toward the scientific enterprise rather than factual knowledge. It has been shown to be reliable in other studies, though it is not often used with tenth grade age level students.

In summary, the TOUS post testing was less than adequate, and the significant gains must be cautiously assessed. Nonetheless, as with the Delaware Educational Assessment Program items and the National Assessment of Educational Progress items, the scores on the TOUS reflect gains over the five year history of the Del Mod System. Gains are noted in two of the three schools tested, and both sexes gained to a significant degree.

Summary of Test Results. Despite flaws in the post testing, some of which were unavoidable, it is extraordinary that gains are to be noted in grades four, ten, and twelve on the various tests which were administered. In grade eight the gains and losses were offsetting.

These gains will require a much more detailed analysis

Table 3. Tenth Grade TOUS Sample Sizes, Means, and Standard Deviations for 1971 and 1976 in Three Delaware High Schools

		Sample Size	Mean	S.D.	Pre- Post Difference	
School 1 - (High Socio-economic)						
Pre	M	192	32.43	9.51		
	F	196	32.82	7.12		
	T	388	32.63	8.39		
Post	M	29	39.07	6.19	+6.64	
	F	22	38.32	5.43	+5.50	
	T	51	38.75	5.89	+6.12	
School 2 - (Low Socio-economic)						
Pre	M	100	21.48	7.89		
	F	100	22.69	6.99		
	T	200	22.08	7.48		
Post	M	7	17.57	3.06	-3.91	
	F	8	20.25	4.71	-2.44	
	T	15	19.00	4.24	-3.08	
School 3 - (Medium Socio-economic)						
Pre	M	114	22.82	7.01		
	F	122	25.52	6.92		
	T	236	24.22	7.09		
Post	M	15	23.80	7.82	+ .98	
	F	16	28.44	7.66	+2.92	
	T	31	26.19	8.08	+1.97	

		Sample Size	Mean	S.D.	Pre- Post Difference	
TOTALS						
Pre	M	406	27.04	9.91		
	F	418	28.26	8.29		
	T	824	27.66	9.15		
Post	M	51	31.63	10.85	+4.59	P<.01
	F	46	31.74	9.27	+3.48	P<.02
	T	97	31.68	10.13	+4.02	P<.001

in the near future, but they may be statistically and socially significant. It is entirely possible that the presence of Del Mod has had the effect in Delaware of positively influencing science achievement. If this is so, the result is exactly the opposite of national trends.

The Delaware Department of Public Instruction played an enormous role in the administration of the post tests, and the problems it created for Del Mod's statistical analysis of results are too numerous to list. Many of these are mentioned in Chapter One. Among other things, the test data arrived too late for the type of statistical treatment originally planned for this report.

REFERENCES

1. DEAP - Delaware Educational Assessment Program. Educational Testing Service, Princeton, New Jersey, 1972, 1974.

2. NAEP - National Assessment of Educational Progress. Modified for use by the Del Mod System (See Appendix A).

3. TOUS - Test On Understanding Science, Form W. W. W. Cooley and L. E. Klopfer, Educational Testing Service, Princeton, New Jersey, 1961.

Chapter Three

SCHOLARLY RESEARCH CONDUCTED UNDER THE AUSPICES OF THE DEL MOD SYSTEM

Reviewed By
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SCHOLARLY RESEARCH CONDUCTED UNDER THE AUSPICES OF THE DEL MOD SYSTEM

Chapter Three

Four scholarly research studies were conducted under the auspices of the Del Mod System during the period 1973-1975. One of the research studies was conducted as a master's thesis project by Kehoe (1973), and three doctoral dissertations were completed by Michalcewiz (1974), Bolig (1974), and Darlington (1975).

Kehoe (1973) attempted to determine the effectiveness of the auto-tutorial video tape package as a vehicle for training pre-service and in-service teachers to use four specified data-gathering techniques. The research sample for this study consisted of fifteen pre-service teachers and fifteen in-service teachers from Delaware school systems. The experimental group had twenty participants divided into two groups, one group of ten pre-service teachers and a second group of ten in-service teachers. The control group consisted of ten participants divided equally between pre-service and in-service teachers.

Utilizing a post-test only control group design for the study, experimental group teachers were required to view the entire auto-tutorial package during one two-hour session. Control group teachers were given the introductory section of each of the six auto-tutorial units and were asked to spend not more than one hour reviewing the materials prior to the post-test session.

With minimal exposure to the auto-tutorial package, 82.5 percent of the total experimental group attained the prespecified competency level for the four data-gathering techniques emphasized in the auto-tutorial packages. No significant differences between pre-service and in-service teachers with respect to competency level attainment were found, and previous teaching experience appeared to have little influence on the participants' performance. No statistical evidence was found which showed any difference in competency level attainment among those who received the video treatment and those who received only the unit introductions describing the techniques. Although no statistical differences were found among groups, an examination of participants' mean scores indicated that both the pre-service experimental and in-service experimental groups had higher scores for each of the four techniques when compared to the control groups (Kehoe, 1973).

Michalcewiz (1974) attempted to determine if there were meaningful differences between selected teacher variables and direct and indirect teaching influence as measured by the Flanders System of Interaction Analysis (FSIA) instrument. A

second purpose of the study was to determine if there were identifiable patterns between those variables and direct or indirect teaching influences. Selected teacher variables included grade point averages in science and education course work at the undergraduate and graduate levels, total grade point averages at the undergraduate and graduate levels, and the total score of the Test On Understanding Science (TOUS) which was administered to each teacher who participated in the study.

Forty-five high school science teachers were randomly selected from the State of Delaware to be video-taped during a normal classroom session. Data were collected from: (1) viewing the videotapes and codifying the events of a twenty-minute segment of classroom activities; (2) an analysis of the selected teachers' transcript data; and (3) from the teacher scores on the TOUS test. Utilizing one-way analysis of variance (ANOVA) techniques on seven subhypotheses, the forty-five teachers were divided into three groups based on ability as measured by grade point averages at: (1) the undergraduate level of science course work; (2) the undergraduate level of education course work; (3) the total undergraduate level of course work; (4) the graduate level of science course work; (5) the graduate level of education course work; and (6) the total graduate level of course work.

The following conclusions were drawn from Michalcewiz's (1974) study: (1) There is probably no significant relationship between the undergraduate or graduate grade point averages in science and education and indirect teaching style in the classroom; (2) there is probably no significant relationship between the total TOUS score and indirect teaching style in the classroom; (3) science teachers in this study tended to explain science concepts more extensively and from several different positions in order to convey their ideas more meaningfully; (4) no significant relationships were found between higher grades and teaching style; and (5) the separation of teachers into ability groups based upon grade point averages appeared to be too fine a distinction to make them significantly different from each other or one group from another. The study appeared to support the idea that science teachers who take more graduate science and education courses tend to "explain more" to their students than teachers who have not taken as many advanced courses.

Bolig (1974) designed an experimental study which examined the effect of sex segregation on the science achievement and understanding of science processes for fifth grade students in a school system in Delaware. Evidence of sex differences in school, particularly in attitudes and interest of children toward various subject areas were cited as the rationale for the study.

Two all-boy and two all-girl classes were compared to heterosexually grouped science classes at the fifth grade level on pre- and post-tests of science achievement as measured by the Sequential Test of Educational Progress: Science Portion. Student understandings of the processes of science were measured by the Delaware Test of Inquiry Skills.

Analysis of post test scores revealed that science achievement and understanding of the processes of science was no greater for children in the sex-segregated classes than their sex-integrated counterparts. Teacher interviews at the conclusion of the study indicated that children in sex-segregated classes worked more cohesively and were more interested in science than children in the sex-integrated classes. Teachers also reported that slower students appeared to benefit more from the sex-segregated classes than students in sex-integrated classes (Bolig, 1974).

Darlington (1975) attempted to determine whether a randomly selected group of Delaware public elementary school teachers, grades three to six, demonstrated significantly different understandings of the nature of science and scientists and different teaching methods when working under the direction of a Del Mod System Science Field Agent as compared to a randomly selected group of teachers who had never worked with a Del Mod Science Field Agent.

The sample consisted of fifty full-time elementary school teachers, grades three to six, employed in the Delaware public schools. The experimental group included twenty-five elementary school teachers selected at random from those teachers who worked with a Del Mod Science Field Agent during the 1973-74 school year. The control group included twenty-five elementary school teachers selected at random who had never worked with a Del Mod Science Field Agent.

Continuous five-minute teaching segments of all teachers participating in the Darlington (1975) study were videotaped and analyzed by a panel of six judges who had no knowledge of which group (experimental or control) the teachers were assigned. Using a seven point scale, the judges rated the fifty videotapes on a series of criteria which represented desirable practices in science teaching. TOUS tests were administered to all teachers participating in the study and scores of the experimental and control groups were compared using the t-test to compare independent sample means.

The following results of Darlington's (1975) study were reported: (1) Delaware public elementary school teachers, grades three to six, who spend a year working with a Del Mod Science Field Agent did not demonstrate significantly different understandings of the nature of science and scientists, as measured

by the TOUS, from Delaware public elementary school teachers who have never worked with a Del Mod Science Field Agent; (2) teachers who have worked with a Del Mod Field Agent have been shown to use an inquiry-based approach and individualized instruction techniques in teaching science to a significantly greater extent than those teachers who have never worked with a Del Mod Science Field Agent; and (3) results indicated that there were no significant differences between teachers who had worked with a Del Mod Science Field Agent with regard to the use of teaching science using materials (other than a textbook), the use of a cross-discipline approach, the use of concrete examples or experiences in science teaching, the use of abstractions, ideas and verbalizations and the use of student encouragement and praise.

Darlington (1975) concluded that if Delaware school administrators are primarily concerned about the lack of an inquiry-based approach to teaching science among their elementary school teachers, the services of a Del Mod Science Field Agent might be employed as a possible means of improving this situation. It was also concluded that if Delaware school administrators would like their elementary school teachers to move towards an individualized instruction approach to teaching science, the services of a Del Mod Science Field Agent should be employed.

To summarize the results of the four research studies which were conducted under the auspices of the Del Mod System in terms of a synthesis of research would be, at best, quite difficult. Each study looked at a different component of the teaching/learning act in terms of teacher and student perceptions of selected portions of that act. Perhaps the greatest contribution of the Del Mod System to the undertaking of these studies was to serve as a facilitator for research which attempted to assess the classroom environment and those variables which affect and effect the learning of science concepts. The Del Mod System attempted to open lines of communications between educational researchers, classroom teachers and school administrators. A significant role played by the Del Mod System in the research conducted under its auspices was that of acting in a supportive fashion which encouraged research to be conducted in an informal, non-threatening environment. Results of the research were shared with administrators and teachers and every effort was made to insure that positive steps were undertaken which would help the classroom teacher translate "theory into action" as a result of that research.

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Chapter Four

A FOLLOW-UP STUDY OF PROJECT 70-1 TEACHERS' PERCEPTIONS OF THE DEL MOD SYSTEM, 1970-1976

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A FOLLOW-UP STUDY OF PROJECT 70-1
TEACHERS'S PERCEPTIONS OF THE
DEL MOD SYSTEM, 1970-1976

CHAPTER FOUR

During the 1970-1971 school year 65 science teachers from Kent and Sussex Counties in Southern Delaware participated in a pilot project designed to upgrade teachers' knowledge of science curriculum developments and new instructional strategies.

One objective of Project 70-1 was to develop a prototype for the Del Mod System field agent concept. The 65 science teachers were divided into six groups and met one full day at two-week intervals for a period of fifteen weeks.

The Project 70-1 courses consisted of mini-lessons related to many of the new science curricula, utilization of micro-teaching strategies, field trips, lectures, workshops, and the development of science teaching units. In addition to the above activities, a training workshop was initiated for substitute teachers who were assigned to cover the classes of the Project 70-1 participants. Program details were developed by the science field agent and the Delaware State Science Supervisor.

During the 1970-1971 school year Project 70-1 teachers were administered pre- and post-TCUS tests. Results of the testing revealed that this program seemed to have had no significant effect on the participants' attitudes toward science or on their understanding of the nature of science. The testing program did, however, reveal that the Project 70-1 activities did promote teacher awareness of new science curriculum developments, alternative science teaching instructional strategies, and the ordering of textbooks and classroom science equipment.

From the initial Project 70-1 activities it was found that cooperation between science teachers and a science field agent was enhanced when the teachers were given release time to work on curriculum development and instructional strategies development. It was also found that school districts were most cooperative in releasing their science teachers when external funding permitted reimbursement of those districts for substitute teacher costs.

An analysis of Project 70-1 activities also indicated that workshop class size should be relatively small, that extensive use of micro-teaching strategies was beneficial to the participants, and that the materials used in the workshops should be inexpensive, easily transported, and adaptable to most science classroom environments. A follow-up study of teacher perceptions of the Project 70-1 activities was recommended by the field agent and the State Science Supervisor in order to determine what, if any, long range effects those activities may have had on the teachers.

During the spring of the 1975-1976 school year, a follow-up study of Project 70-1 teachers was initiated by the office of the Del Mod Research Director, Dr. John R. Bolig. The whereabouts of the sixty-five original Project 70-1 teachers were determined, where possible, and the follow-up study described in the following paragraphs was undertaken.

Of the original sixty-five teachers participating in Project 70-1, forty-four teachers remained in the Delaware public school system. The other twenty-one teachers had left the state to take other teaching positions, had left teaching to undertake other vocations, and/or were not available for the follow-up study.

The forty-four teachers were contacted by the Del Mod Research Director's office through the use of a questionnaire. Forty-one of the Project 70-1 teachers returned useable questionnaires for analysis. This response represents a return of 93.18% of the questionnaires. A sample of the Project 70-1 questionnaire is found in Appendix B. All data described below have been reported in terms of the number of teachers and the corresponding percentages of those numbers when compared to a total of forty-four responses, except where noted.

Thirty-eight (92.7%) of the respondents have remained in the classroom since 1970. One of the teachers became a guidance counselor during the 1972-73 school year and has not taught science since that time. Two teachers became assistant principals during the 1972-73 school year and there is evidence to show that two additional Project 70-1 teachers became assistant principals. The additional two teachers did not respond to the questionnaire and are therefore not considered in the analysis of the data.

Thirty-eight (92.7%) of the respondents have taught a wide variety of subjects at many levels of instruction as reported in Tables 1-6, which identify those grade level and subject area assignments. An analysis of individual teacher assignments suggests that most of the Project 70-1 teachers had at least three different preparations per day and had no consistent grade level or subject area assignment for more than two years at a time.

Question Six On question six of the questionnaire respondents were asked to list the science or science education and/or math and math education graduate courses they had taken at institutions outside Delaware during the period 1970-1976.

During the 1970-71 school year, thirty-nine (95.1%) of the respondents did not take out-of-state graduate coursework in science, science education, mathematics, or mathematics education. One teacher took out-of-state coursework but did not list the course title or institution where the coursework was taken. A second teacher took an organic chemistry course at Murray State College.

Table 1. Percentages of Project 70-1 Teachers and Subject Area Assignments During The 1970-71 School Year

GRADE LEVEL	Physical Sci.	Life Science	Earth Science	Chemistry	Biology	Health	Reading	Adv. Biology	General Sci.	Science (unidentified)	Astronomy	Ecology	Physics
5		2.4					2.4			9.8			
6	2.4									12.2			
7		34.1	2.4			2.4				9.8			
8	2.4		34.1			2.4			2.4	12.2			
9	4.9				2.4					2.4			
10					4.9								
11								2.4					
12								2.4					

Table 2. Percentages of Project 70-1 Teachers and Subject Area Assignments During The 1971-72 School Year

GRADE LEVEL	Physical Sci.	Life Science	Earth Science	Chemistry	Biology	Health	Reading	Adv. Biology	General Sci.	Science (Unidentified)	Astronomy	Ecology	Physics
5		2.4					2.4			7.3			
6	2.4									12.2			
7		34.1	2.4							14.6			
8	2.4		29.3						2.4	9.8			
9	4.9				2.4					2.4			
10					4.9								
11				2.4									2.4
12				2.4									2.4

Table 3. Percentages of Project 70-1 Teachers and Subject Area Assignments During The 1972-73 School Year*

GRADE LEVEL	Physical Sci.	Life Science	Earth Science	Chemistry	Biology	Health	Reading	Adv. Biology	General Sci.	Science (Unidentified)	Astronomy	Ecology	Physics
5		4.9					4.9			7.3			
6	2.4									2.2			
7		34.1	2.4							9.8			
8			26.8			2.4				9.8	2.4		
9	4.9				2.4					2.4			
10					4.9								
11				2.4									2.4
12				2.4									2.4

*One Project 70-1 teacher was a guidance counselor for grades 1-12 during the 1972-73 school year,(2.4%), and two Project 70-1 teachers were assistant principals during the 1972-73 school year, (4.9%).

Table 4. Percentages of Project 70-1 Teachers and Subject Area Assignments During The 1973-74 School Year*

GRADE LEVEL	Physical Sci.	Life Science	Earth Science	Chemistry	Biology	Health	Reading	Adv. Biology	General Sci.	Science (Unidentified)	Astronomy	Ecology	Physics
5		7.3					4.9						
6	4.9									4.9			
7	2.4	29.3	2.4			2.4	2.4			12.2			
8	2.4		26.8			2.4				14.6	2.4		
9	2.4									2.4			
10	2.4	2.4											
11	2.4			2.4									
12	2.4			2.4									2.4

*One Project 70-1 teacher was a guidance counselor for grades 1-12 during the 1973-74 school year, (2.4%), and two Project 70-1 teachers were assistant principals during the 1973-74 school year, (4.9%).

Table 5. Percentages of Project 70-1 Teachers and Subject Area Assignments During The 1974-75 School Year*

GRADE LEVEL	Physical Sci.	Life Science	Earth Science	Chemistry	Biology	Health	Reading	Adv. Biology	General Sci.	Science (Unidentified)	Astronomy	Ecology	Physics
5		4.9					4.9						
6	2.4									9.8			
7	2.4	31.7	2.4				2.4			12.2			
8	4.9		29.3							14.6	2.4		
9	2.4									2.4			
10													
11	2.4			2.4									
12	2.4			2.4									2.4

*One Project 70-1 teacher was a guidance counselor for grades 1-12 during the 1974-75 school year, (2.4%), and two Project 70-1 teachers were assistant principals during the 1974-75 school year, (4.9%).

Table 6. Percentages of Project 70-1 Teachers and Subject Area Assignments During The 1975-76 School Year*

GRADE LEVEL	Physical Sci.	Life Science	Earth Science	Chemistry	Biology	Health	Reading	Adv. Biology	General Sci.	Science (Unidentified)	Astronomy	Ecology	Physics
5		7.3					4.9						
6	2.4									7.3			
7	2.4	24.4					2.4			14.6			
8	7.3		24.4				2.4			14.6	2.4		
9	4.9									2.4		4.9	
10												4.9	
11				2.4	2.4							4.9	
12				2.4	2.4							4.9	2.4

*One Project 70-1 teacher was a guidance counselor for grades 1-12 during the 1975-76 school year, (2.4%), and two Project 70-1 teachers were assistant principals during the 1975-76 school year, (4.9%).

During the 1971-72 school year, thirty-nine (95.1%) of the respondents took no coursework outside Delaware in science, science education, mathematics, or mathematics education. One teacher enrolled in a course entitled "Animal Science Workshop", but did not identify the institution at which the course was taken. One teacher enrolled in "Organic Chemistry and Physical Chemistry" at Slippery Rock State College.

Of the 42 respondents to the questionnaire, only two enrolled in out-of-state courses during the 1972-73 school year. One teacher enrolled in a course entitled "Plant Science Workshop " and another teacher enrolled in "Teaching General Science"; neither teacher indicated which institution sponsored those courses.

During the 1973-74 school year, thirty-eight (92.7%) did not undertake out-of-state graduate coursework. Two teachers enrolled at Salisbury State College in courses entitled "Biology and Environment", and "Introduction to Research". A third teacher enrolled in a physics course at Slippery Rock State College and did not identify the course by title.

Thirty-nine teachers (95.1%) did not take out-of-state coursework during the 1974-75 school year. Two teachers undertook coursework at Salisbury State College, one teacher enrolling in "Modern Concepts of Biology" and "Recent Issues in Education." The second teacher enrolled in courses entitled "Public School Administration", "Curriculum Construction", and "Secondary School Guidance".

During the 1975-76 school year, thirty-nine (88.6%) of the teachers took no coursework at out-of-state institutions. One teacher enrolled in two courses at Salisbury State College in cooperation with Western Connecticut State College entitled, "Field Biology" and "Marine Biology". This teacher also was enrolled in "Public School Administration" at the same institution. A second teacher enrolled at Salisbury State College in courses entitled, "Critics in Education" and "Seminar in Mathematics".

In summary of question number six, "list the out-of-state coursework you have taken during the period 1970-1976", it would be safe to say that very few of the Project 70-1 teachers went out of the state for coursework in science, science education, mathematics, or mathematics education. The responding teachers did not take advantage of the National Science Foundation (NSF) summer or academic year institutes during that period. NSF summer institutes were still being offered on a limited basis in 1974, and the academic year institutes were offered as late as 1973.

Question Seven On question number seven on the questionnaire, teachers were asked to list their advanced graduate degrees and the institutions at which those degrees were completed during the period 1970-1976. Twenty-five (60.9%) of the teachers did not complete advanced degrees or certificates of advanced study during that period. Eight (19.5%) of the respondents

completed the Masters Degree in Education (M.Ed.): two teachers completed their M.Ed. degrees at the University of Delaware, two teachers completed their degrees at Salisbury State College, one teacher at the University of Virginia, one teacher at the University of Pennsylvania, and one teacher at Franklin and Marshall University.

Three teachers completed the Master of Science (M.S.) degree at the University of Delaware. One teacher completed the Master of Arts (M.A.) degree at Murray State College and one teacher completed a Masters of Forestry (M.F.) at Duke University. Three teachers completed advanced certificates of study (i.e., a B.S. + 30 semester hours); two teachers completed their advanced certificates of study at the University of Delaware and one teacher completed advanced coursework at Salisbury State College.

Question Eight On question number eight teachers were asked to rate their opinions of the effectiveness of the following components of the three Science/Math Resource Centers located at Georgetown, Dover, and Newark, Delaware: field agent activities, resource center staff cooperation, resource center business hours, resource center newsletters, availabilitty of science/math curriculum materials, quality of science/math curriculum materials, length of curriculum materials checkout period, and workshop quality.

As the three Science/Math Resource Centers were geographically distributed around the State of Delaware, most of the teachers did not visit all three centers. Most teachers visited the center nearest to them during the 1970-1976 period, but many teachers visited at least two centers during that period. In light of the geographical distribution of the three centers (Georgetown, Dover, and Newark), it was decided to analyze teacher opinions concerning the above listed components on an individual center basis. Data listed in Tables 7-9 reflect the teacher opinions of center component effectiveness for the Delaware State College Science/Math Resource Center at Dover (Table 7), University of Delaware Science/Math Resource Center at Newark (Table 8), and the Delaware Technical and Community College Science/Math Resource Center at Georgetown (Table 9).

Twenty-two (53.7%) of the teachers have not visited the Delaware State College Science/Math Resource Center during the period 1970-1976. Nineteen (46.3%) of the respondents visited the Dover center during that period. Their opinions of the effectiveness of selected components of the center are reported in Table 7.

Thirty-four (82.9%) of the teachers have not visited the University of Delaware Science/Math Resource Center during the 1970-1976 period. Seven (17.1%) of the respondents indicated that they had visited the Newark center during that period. Their ratings of the effectiveness of selected components of the Newark center are reported in Table 8.

Table 7. Effectiveness Ratings of the Delaware State College Science/Math Resource Center in Dover by Nineteen Project 70-1 Teachers

	Little Effect						Great Effect
Component	1	2	3	4	5	6	7
Field Agent Activities	5.3			26.3	15.8	10.5	42.1
Resource Center Staff Cooperation		5.3	5.3	5.3	15.8	31.6	36.8
Resource Center Hours of Business		15.8	15.8		21.1	26.3	21.1
Center Newsletters*	15.3	10.5	10.5	5.3		15.8	15.8
Availability of Curric. Materials	26.3	5.3	10.5	10.5	10.5	21.1	15.8
Quality of Curric. Materials	10.5	10.5	26.3		10.5	26.3	15.8
Length of Checkout Period	15.8		5.3	10.5	26.3	15.8	26.3
Workshop Quality	42.1	5.3	21.1	10.5		10.5	10.5

*Delaware State College began publishing its Newsletter in 1975-76.

Table 8. Effectiveness Ratings of the University of Delaware Science/Math Resource Center in Newark by Seven Project 70-1 Teachers

	Little Effect						Great Effect
Component	1	2	3	4	5	6	7
Field Agent Activities					14.3	14.3	71.4
Resource Center Staff Cooperation	14.3					42.8	42.8
Resource Center Hours of Business	14.3				14.3	28.6	42.8
Center Newsletters*	42.8	57.1					
Availability of Curric. Materials	14.3				14.3	42.8	28.6
Quality of Curric. Materials		14.3		14.3	14.3	14.3	42.8
Length of Checkout Period		14.3	14.3		42.8		28.6
Workshop Quality	14.3			14.3	14.3	28.6	28.6

*The University of Delaware published its Newsletter only in 1971-72.

Seven (17.1%) of the teachers have not visited the Delaware Technical and Community College Science/Math Resource Center during the 1970-1976 period. Thirty-four (82.9%) of the respondents indicated that they had visited the Georgetown center during that period. Their ratings of the effectiveness of selected components of the Georgetown center are reported in Table 9.

Project 70-1 teachers were asked to rate their opinions of the effectiveness of selected components of the three Science/Math Resource Centers. Each component and teacher perceptions of the effectiveness of those components will be discussed separately.

Teachers generally rated the field agent activities at each of the Resource Centers as effective or highly effective (Tables 7-9). Ratings of field agent activities tended to be highest at the University of Delaware Center (Table 8) and the Delaware Technical and Community College center (Table 9). Those ratings may reflect the fact that two agents at each center had office space and used those centers more than they used the Dover center. The ratings were somewhat suspect in that the number of teachers visiting each center varied significantly, i.e., nineteen teachers (46.3%) visited the Dover center, seven teachers (17.1%) visited the Newark center, and thirty-four teachers (82.9%) visited the Georgetown center. It would be safe to say that field agent activities were generally rated as the most effective at the Georgetown center.

Resource center staff cooperation was perceived to be most effective at the Georgetown resource center. Perhaps these ratings were due to that center's staff having longer hours during its first four years, having been located in school systems that have less economic support for education than the northern centers, and having had a full time staff to assist teachers in all areas of science and mathematics for a longer period of time than the other centers.

The Resource Center newsletter at Georgetown received the highest ratings from the respondents. The center's newsletter has been published for the longest period of time and has the largest circulation (approximately 1500 per month). The University of Delaware Resource Center published a newsletter only during the 1971-72 school year and the Delaware State College Resource Center began publishing its newsletter during the 1975-76 school year. It is suspected that many of the teacher ratings of the three center newsletters were in reality related to the Georgetown center newsletter, as that newsletter had the largest distribution over the greatest period of time.

Project 70-1 teachers generally rated the resource center hours of business to be most highly effective at the Georgetown center. Until recently that center had the longest hours of any of the centers.

Table 9. Effectiveness Ratings of the Delaware Technical and Community College Science/Math Resource Center in Georgetown by Thirty-Four Project 70-1 Teachers

	Little Effect						Great Effect
Component	1	2	3	4	5	6	7
Field Agent Activities	2.9	5.9	5.9	8.8	20.1	5.9	47.1
Resource Center Staff Cooperation					8.8	14.7	76.5
Resource Center Hours of Business				2.9	2.9	23.5	70.6
Center Newsletters*					2.9	17.6	79.4
Availability of Curric. Materials					14.7	26.5	58.8
Quality of Curric. Materials					2.9	41.8	55.9
Length of Checkout Period		2.9		8.8	17.6	32.4	38.2
Workshop Quality				2.9	11.8	23.5	61.8

*The Georgetown Science/Math Resource Center began publishing its Newsletter during the 1971-72 school year.

Respondents to the questionnaire rated the availability of curriculum materials as most effective at the Georgetown resource center. One reason for this rating may be that more of the teachers visited that center. Another might be that the resource center staff at Georgetown was available for more hours of the day to meet specific needs of the teachers. At Newark, the emphasis was on pre-service teachers in a larger number of areas than at Georgetown or Dover. At Dover, the resource center emphasis was on pre-service teachers in a larger number of areas than at Georgetown or Dover. At Dover, the resource center emphasis was primarily on pre-service teacher needs. With respect to actual teacher needs, the Georgetown center appeared to have met more classroom teacher needs and was therefore given the highest ratings for making curriculum materials available.

The quality of resource center curriculum materials was most highly rated at the Georgetown resource center. In addition to having more teachers visiting the Georgetown resource center, the ratings probably reflect the organization and presentation of those materials. Curriculum materials were centrally located at the Georgetown resource center whereas at the Dover center they were distributed across several rooms and at the Newark center the science curriculum materials were housed with materials from other educational curriculum areas.

Project 70-1 teachers rated the length of time materials could be checked out for to be most effective at the Georgetown resource center. Respondents tended to borrow more materials from the Georgetown center than they did at the other centers which probably reflects their ratings in this category. Another factor may have influenced teacher ratings in this category, i.e., teachers could do considerable borrowing of materials (and the renewing of the checkout period for those materials) via telephone and/or courier mail service at the Georgetown center. Since most requests for checkout renewal were granted, more teachers were able to use the materials for greater lengths of time.

The teachers generally rated the workshop quality at the Georgetown resource center to be the most effective. This is probably because more teachers attended more workshops at that center than they did at other resource centers. As the teachers rated the Georgetown resource center staff as the most cooperative, this too may have effected higher ratings in this category.

Question Nine Question number nine asked the Project 70-1 teachers if they had purchased science curriculum materials as a result of having a chance to evaluate those materials at one of the Science/Math Resource Centers prior to their purchase.

Fourteen of the responding teachers (34.1%) indicated that they had purchased science curriculum materials after having

had the chance to evaluate them at a resource center and/or in their classrooms.

Twenty-two (53.7) of the teachers indivated that they had not purchased curriculum materials as a result of having seen and/or used them at a resource center and/or in their classrooms. Sixteen of those responding (39.0%) indicated that teachers in their respective school systems were not allowed sufficient funds to purchase such materials and four teachers indicated that they had been attracted to certain curriculum materials through advertisements in professional science education journals and, after reviewing those materials in a science/math resource center, decided not to purchase them. Two teachers indicated that while they had used materials from one or more resource centers that were appropriate for their classrooms, they were not allowed to choose those materials, i.e., their supervisors made all equipment and curriculum materials purchases without consulting the teachers.

Three teachers indicated that they collected their own curriculum materials and therefore did not use the materials housed at the resource centers in their respective classrooms.

Question Ten Question number ten asked the Project 70-1 teachers if they had not purchased equipment after having evaluated those materials at a resource center or in their classroom.

Eighteen teachers (43.9%) indicated that after reviewing science curriculum materials at a resource center or in their classrooms they had decided not to purchase those materials. An original objective of the resource centers was to provide current science and mathematics curriculum for teacher evaluation. Results from the questionnaire would indicate that many of the Project 70-1 teachers did just that when they had: (a) the budget to purchase materials; (b) administrative support in the curriculum evaluation process; and (c) time to evaluate those curriculum materials as a part of their role as a teacher.

Thirteen teachers (31.7%) indicated that they had purchased curriculum materials after having evaluated them under classroom conditions. Perhaps in the future, school systems will follow the resource center model in providing materials for their teachers to test under classroom conditions prior to the expenditure of large amounts of money for those materials, only to find that they are inappropriate for their students.

Eleven teachers (26.8%) indicated that whereas they saw materials at a resource center which were or were not appropriate for their classrooms, budgetary restrictions and/or administrative restrictions were such that they were unable to purchase materials and/or had little say in the selection of those materials.

Question Eleven This question asked the Project 70-1 teachers to indicate their opinions of the effect(s) of the Del Mod System on their classroom activities during the period 1970-1976. Teacher ratings of the effect(s) of Del Mod on improving their classroom activities are presented in Table 10.

Responding to Del Mod System attempts to improve classroom teacher instructional skills, twenty-eight teachers (68.3%) rated Del Mod System instructional improvement activities as having had a moderately effective to highly effective impact on their classroom activities. Twenty-eight teachers (68.3%) rated Del Mod System instructional improvement activities as having had a moderately effective to highly effective impact on their classroom activities. Twenty-eight teachers (68.3) also indicated that Del Mod System Science/Math Resource Centers and science field agents were moderately effective to highly effective in making them aware of new developments in science and/or mathematics teaching.

Thirty-four teachers (82.9%) rated the Del Mod System as having been moderately effective to highly effective in improving their awareness of new developments in science and/or mathematics curriculum materials.

Twenty-nine (70.7%) teachers rated the Del Mod System attempts to improve their awareness of educational resources in the State of Delaware (e.g., field trip sites, free materials published by state agencies, resource people, etc.) as moderately effective to highly effective. Twenty-nine (70.7%) of the respondents also rated Del Mod System attempts to open communication channels between science and mathematics teachers in Delaware as moderately effective to highly effective. Thirty-three teachers (80.5%) also gave similar ratings to Del Mod's attempts to improve their awareness of professional meetings and activities via the Del Mod System newsletters.

Question Twelve Project 70-1 teachers were asked in question twelve to rate the effectiveness of the Del Mod System workshops, Del Mod/Department of Public Instruction (DPI) graduate courses, Del Mod conferences, and Del Mod field trips, on their classrooms.

Twenty-seven (65.9%) of the teachers rated the Del Mod System workshops as having had moderate to greatly positive effects on their classroom situations (Table 11).

Graduate courses sponsored by the Del Mod System and the Delaware State Department of Public Instruction were rated by twenty-nine teachers (70.1%) as having been moderately to highly effective in influencing their classroom activities.

Conferences sponsored by the Del Mod System (state-wide in-service days, etc.) were rated as moderately to highly effective in influencing classroom activities by twenty-three

Table 10. Project 70-1 Teacher Ratings of the Effects(s) of Del Mod System Activities on Their Classroom Activities for the Period 1970-76

	Little Effect						Great Effect
A. On improving your teaching skills	1	2	3	4	5	6	7
B. On making your courses more laboratory & investigative in orientation	4.9	4.9	4.9	17.1	24.4	26.8	17.1
C. On improving your awareness of new developments in science and/or math teaching	2.4	3	12.2	9.8	19.5	26.8	21.9
D. On improving your awareness of new science and/or math curriculum materials	4.9		9.8	4.9	21.9	21.9	39.0
E. On improving your awareness of educational resources in the State of Delaware (e.g., field trip sites, resource people, free materials published by state agencies)	2.4	2.4	7.3	17.1	26.8	17.1	26.8
F. On improving your communication with other science and/or math teachers in your system and elsewhere in the State of Delaware	4.9	2.4	9.8	12.2	19.5	24.4	26.8
G. On improving your awareness of activities and meetings via the Del Mod Newsletters	2.4	2.4	2.4	12.2	19.5	24.4	36.6

Table 11. The Effectiveness of Del Mod Sponsored Activities on The Classroom as Rated by Forty-One Project 70-1 Teachers

	Little Effect 1	2	3	4	5	6	Great Effect 7
A. Del Mod System Workshops	9.8		4.9	19.5	9.8	21.9	34.1
B. Del Mod System/DPI graduate courses	9.8	4.9	7.3	7.3	14.6	26.8	29.3
C. Del Mod System conferences	9.8	7.3	9.8	17.1	19.5	14.6	21.9
D. Del Mod System field trips	9.8	7.3	12.2	4.9	21.9	19.5	24.4

(56.1%) of the respondents. As discussed in respondents' reactions to questions eighteen and nineteen, a number of teachers suggested that the strong points of the Del Mod System were the many conferences for classroom teachers. A number of teachers also suggested that if the Del Mod System were refunded, more conferences should be offered on in-service days, statewide in-service days, and released time days.

Field trips sponsored by the Del Mod System were rated, in terms of their effect(s) on science classroom activities, as moderately to highly effective by twenty-seven (65.9%) of the teachers. As questions seventeen through nineteen will later indicate, many teachers thought that not only were the field trips effective but that more such field trips should be offered in the future.

Question Thirteen Question thirteen on the questionnaire asked Project 70-1 teachers to rate their colleagues' attitudes toward the Del Mod System and its activities during the period 1970-76. As indicated by Table 12, thirty-two (78.0%) of the teachers responded that their colleagues had moderate to highly positive attitudes toward Del Mod and its efforts to improve science instruction in Delaware. Analysis of data pertaining to questions eighteen and nineteen in subsequent paragraphs will further reinforce the positive attitudes expressed toward the Del Mod System during the period 1970-1976.

Question Fourteen Question fourteen was directed toward identifying Project 70-1 teachers' roles in curriculum articulation as a direct or indirect result of activities sponsored by the Del Mod System. Twenty-eight (68.3%) of the respondents indicated that they had undertaken curriculum articulation activities involving the following grade level combinations: grades 1-2 (2 teachers); grades 1-8 (1 teacher); grades 4-8 (1 teacher); grades 7-8 (4 teachers); grades 7-12 (1 teacher); grades 5-8 (9 teachers); grades 5-9 (1 teacher); grades 5-12 (1 teacher); and grades 5-7 (1 teacher).

The twenty-eight (68.3%) Project 70-1 teachers participated in curriculum articulation activities sponsored by Del Mod System funding at the following grade levels: grade 1 (3 teachers); grade 2 (3 teachers); grade 3 (3 teachers); grade 4 (4 teachers); grade 5 (17 teachers); grade 6 (18 teachers); grade 7 (24 teachers); grade 8 (23 teachers); grade 9 (6 teacher); grade 10 (4 teachers); grade 11 (4 teachers); and grade 12 (4 teachers).

Thirteen respondents (31.7%) did not participate in curriculum articulation activities under Del Mod System sponsorship during the period 1970-76.

Question Fifteen Question fifteen was directed toward identifying Project 70-1 teachers' roles in curriculum revision activities as a direct or indirect result of Del Mod System funding during the period 1970-76. Thirty-two (78.0%) of the

Table 12. Project 70-1 Teachers' Perceptions of Del Mod Activities For the Period 1970-1976

Very Negative Feelings				Very Positive Feelings		
1	2	3	4	5	6	7
4	6	0	12	27	27	24

Table 13. Teacher Recommendations for Continuing Selected Activities Pending Future Funding of the Del Mod System*

PROGRAM	YES	NO	NO COMMENT
SCIENCE FIELD AGENT	70.7	21.9	7.3
MATH FIELD AGENT	51.2	17.1	31.7
IN-SERVICE PROGRAMS	92.7		7.3
TEACHER MINI-GRANTS	82.9	7.3	9.8
CONFERENCES	80.5	7.3	12.2
NEWSLETTERS	95.1		4.9
RESOURCE CENTERS	95.1		4.9
FIELD TRIPS	80.5	12.2	7.3

*Numbers represent the percentages of Project 70-1 teachers responding to each item of the total forty-one respondents.

Project 70-1 teachers participated in Del Mod System sponsored curriculum development activities involving the following grade level combinations: grades 1-12 (2 teachers); grades 7-12 (2 teachers); grades 5-8 (10 teachers); grades 6-8 (2 teachers); grades 3-12 (1 teacher); grades 7-8 (4 teachers); grades 5-9 (2 teachers); grades 5-12 (2 teachers); grades 1-8 (1 teacher); and grades 5-7 (1 teacher).

The thirty-two (78.4%) of the Project 70-1 teachers indicated that they had participated in curriculum revision activities during the period 1970-76 at the following grade levels: grade 1 (2 teachers); grade 2 (2 teachers); grade 3 (2 teachers); grade 4 (2 teachers); grade 5 (17 teachers); grade 6 (20 teachers); grade 7 (26 teachers); grade 8 (26 teachers); grade 9 (8 teachers); grade 10 (6 teachers); grade 11 (6 teachers); and grade 12 (6 teachers).

Nine (21.9%) of the Project 70-1 teachers did not participate in curriculum revision activities during the 1970-76 period under Del Mod System sponsorship.

Question Sixteen Question sixteen asked the Project 70-1 teachers to indicate which of selected Del Mod System programs should be continued in the future if new funding was found to continue those programs. The respondents were asked to indicate their preference for continuation of the following Del Mod System programs: science field agents, math field agents, inservice programs, teacher mini-grants, conferences, newsletters, resource centers and field trips. Table 13 presents Project 70-1 teacher preferences for program continuation.

Twenty-nine (70.7%) of the respondents indicated that they favored the continuation of the science field agents should the Del Mod System gain new funding. Twenty-one of the respondents (51.2%) indicated that they wished to see the math field agents continued should new funding be awarded. Thirty-eight (92.7%) teachers favored continuation of in-service programs, thirty-four (82.9%) favored continuation of the teacher mini-grant program, thirty-three (73.2%) teachers favored continuing the conferences, thirty-nine (95.1%) teachers urged continuance of the newsletters, resource center continuance was suggested by thirty-nine (95.1%) of the teachers, and thirty-three (73.2%) of the teachers favored continuing the Del Mod System field trips.

Question Seventeen Twenty-five (60.1%) of the respondents to this question suggested that the weak points of the Del Mod System are as follows:

A. "Del Mod should have paid for more teacher release time so that they would have more free time to review new curricula, work on curriculum development projects, objective writing, etc." (3 respondents made this comment)

B. "The Del Mod System tried to do too much with too few personnel." (2 respondents)

C. "The Delaware State College Science/Math Resource Center personnel were never around, did not have their equipment together, was poorly organized, did little to help the science teacher, and was not worth the expenses involved." (17 respondents)

D. "Two field agents available to help a majority of Delaware's science teachers." (5 respondents)

E. "Del Mod should have sponsored more field trips during the school day and paid for teacher release time." (4 respondents)

F. "Del Mod should have made a state wide assessment of the needs of Delaware Science Teachers and then attempted to meet those needs." (1 respondent)

G. "Too much emphasis on materials available for the science teacher and laboratory oriented science activities for the student." (1 respondent)

H. "Del Mod should have spent more time contacting teachers, department heads, supervisors, and administrators to state what Del Mod was all about and what services it offered. As a result, too many teachers took Del Mod for granted and did not actively participate in Del Mod activities." (1 respondent)

I. "It is impossible to get released time from our supervisors in_____ school district to go to the Science/Math Resource Centers. If Del Mod could have overcome this obstacle it would allow more teachers to get to the Centers." (7 respondents)

J. "Del Mod should have offered more courses for science teachers in Sussex County." (4 respondents)

K. "The Science/Math Resource Centers were too small; rooms should have been set aside so that science teachers could set up experiments found in the curriculum materials kits for extended periods of time." (3 respondents)

L. "Checkout periods for the loan of materials at the Resource Centers were too short." (6 respondents)

M. "All Resource Centers should have had copies of their inventories to give the teachers; this would help the teachers know what was available and where it was located." (3 respondents)

N. "There should have been more Science and Math Field Agents appointed so that they could have made more visits to the teachers." (9 respondents)

O. "Offer more summer school courses for science teachers at various locations in the state; offer them on a tuition-free basis." (6 respondents)

P. "Del Mod should sponsor more Drive-In Conferences on the State In-Service Days." (3 respondents)

Q. "More Science Field Agents would have provided more follow-up on projects initiated by the teachers." (2 respondents)

R. "The National Science Foundation and the Du Pont Company should have provided more funds for helping science teachers in Delaware...the Department of Public Instruction doesn't have that kind of money." (2 respondents)

S. "The distance from my classroom to the nearest Center was too far to drive after school...more Centers should have been established." (4 respondents)

T. "Del Mod did not spend enough time educating our administrators about the value of well-trained science teachers." (6 respondents)

U. "Too much emphasis on elementary science; not enough emphasis was placed by the Field Agents on middle and secondary school science." (8 respondents)

Question Eighteen Thirty-two (78.0%) respondents to question number eighteen indicated their perceptions of the strong points of the Del Mod System by making the following comments:

A. "Review and exposure to the new developments in science curricula and teaching strategies." (14 respondents)

B. "The free courses offered to teachers." (17 respondents)

C. "The Sea Beside Us Project." (1 respondent)

D. "The courses offered by Del Mod/DPI/University of Delaware." (11 respondents)

E. "The Georgetown Resource Center was excellent and its staff was extremely helpful at all times." (21 respondents)

F. "The Newsletter sent out by the Georgetown Resource Center." (16 respondents)

G. "The courses featuring behavioral objective writing." (3 respondents)

H. "The astronomy course at Delaware State College was very helpful." (2 respondents)

I. "The curriculum materials made available to science teachers by the Del Mod Science/Math Resource Centers were helpful, especially since our school system doesn't want to spend money on such materials." (8 respondents)

J. "Mini-grants to teachers for curriculum development activities." (3 respondents)

K. "The Del Mod System improved communication between science teachers within school districts and with teachers in other school districts." (5 respondents)

L. "In-service workshops for science teachers." (9 respondents)

Question Nineteen This question asked Project 70-1 teachers for their recommendations on how to improve the Del Mod System if it were to be refunded in the future. Twenty-seven (65.9%) of the respondents made the following comments:

A. "Give the classroom teacher more released time to develop science curricula." (5 respondents)

B. "Reorganize the Delaware State Resource Center by replacing kits that were torn apart and have become useless. Prevent college classes from using the equipment kits, change the hours to be more beneficial to the teachers, and offer more courses for the earth science teacher." (4 respondents)

C. "Offer more courses for middle and secondary school science teachers." (8 respondents)

D. "Improve the various Centers' methods of distribution of equipment and books." (3 respondents)

E. "Find out the needs of the teachers and then help them fulfill those needs." (2 respondents)

F. "Offer more courses on curriculum development activities, behavioral objectives design, and evaluation methods." (3 respondents)

G. "Hire more Field Agents...this will provide more help to more teachers." (6 respondents)

H. "Offer more mini-courses to science teachers." (2 respondents)

I. "Make more efforts to get our supervisors and administrators to support our science teaching improvement activities." (5 respondents)

J. "Offer more field trips (especially during the school day) and pick up the tab for the teachers' released time." (4 respondents)

K. "Better instructors for the graduate courses...the Field Agents were all very good, but the University of Delaware science education faculty has no idea what a "hands-on approach to science teaching" means." (7 respondents)

L. "The Del Mod System should be developed for all curriculum areas." (3 respondents)

M. "Expand the Science/Math Resource Centers in both size and quantity." (8 respondents)

N. "Lengthen the materials checkout period at all Resource Centers." (11 respondents)

O. "Develop mobile units containing science materials; have the Field Agents give assemblies to our students." (4 respondtnts)

P. "Coordinate Resource Centers with the school districts to permit more released time for teachers to use the Centers." (7 respondents)

Question Twenty This question asked Project 70-1 teachers to whom they would turn for science and/or math curriculum development, curriculum revision, instructional strategies, and curriculum awareness assistance when the Del Mod System funding was terminated. Twenty-seven (65.9%) teachers made the following comments:

A. "Delaware Science Teachers Association." (1 respondent)

B. "My school district's science/math coordinator." (3 respondents)

C. "The state science supervisor." (5 respondents)

D. "University of Delaware courses." (6 respondents)

E. "Books, professional journals, etc." (5 respondents)

F. "It is not worth the expense of furthering my education any more as our school system doesn't provide any rewards for doing so." (3 respondents)

G. "Wherever I can get help." (7 respondents)

H. "Not from our school district supervisors...they have no background or interest in science teaching." (3 respondents)

I. "Me and my pocketbook." (6 respondents)

J. "No where." (6 respondents)

K. "Georgetown Science/Math Resource Center." (11 respondents)

L. "Other teachers." (2 respondents)

M. "Federal government." (1 respondent)

N. "Local resource people." (1 respondent)

APPENDIX A

MODIFIED NATIONAL ASSESSMENT TEST

1. At the present time nearly all gasoline comes from

   A. coal.
   B. petroleum.
   C. water.
   D. wood.
   E. I don't know.

2. Information about which one of the following is most important in predicting weather?

   A. The available supplies of water
   B. The daily extremes of humidity
   C. The daily extremes of wind speed
   D. The daily extremes of temperature
   E. The movement and characteristics of air masses
   F. I don't know.

3. An electric current in a copper wire involves mainly the movement of

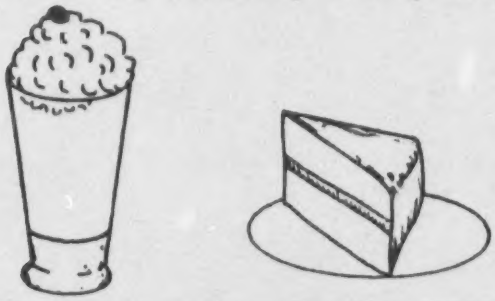
   A. copper atoms.
   B. copper molecules.
   C. electrons.
   D. neutrons.
   E. protons.
   F. I don't know.

4. Changes such as the conversion of limestone to marble or of soft coal to hard coal are explained as having been brought about

   A. by heat and pressure below the Earth's surface.
   B. by exposure to gases from a volcano.
   C. by sudden cooling of the material.
   D. by the action of CO_2 from the atmosphere.
   E. by exposure to an underground river.
   F. I don't know.

5. Which of the following would most closely represent a balanced meal?

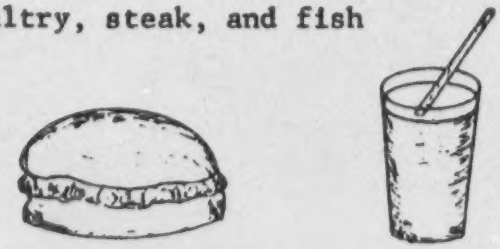
A. Potatoes, oatmeal, bread, and bananas



B. Ice-cream soda and cake

C. Steak, bread, carrots, and milk

D. Poultry, steak, and fish



E. Hamburger and coke

F. I don't know.

6. Which of the following can be detected with unaided human eyes?

   A. X-rays
   B. Radio waves
   C. Certain wavelengths of light
   D. The Earth's magnetic field
   E. Television waves
   F. I don't know.

7. Which of the following animals that have been found as fossils in rocks have NEVER been seen alive by man?

   A. Dinosaurs
   B. Horses
   C. Locusts
   D. Oysters
   E. Shrimp
   F. I don't know.

8. The solid, liquid, and gaseous states of water differ in which of the following ways?

   A. The number of protons per molecule
   B. The number of electrons per molecule
   C. The net charge on the individual molecules
   D. The number of neutrons per individual molecule
   E. The average speed with which the molecules are moving
   F. I don't know.

9. Which of the following acts as a stimulant to the heart?

   A. Adrenaline
   B. Alcohol
   C. Aspirin
   D. Barbiturates
   E. Penicillin
   F. I don't know.

10. Research into the nature of matter shows that it is made up of

   A. continuous uniform material.
   B. uniform stationary particles.
   C. individual moving particles.
   D. smooth rolling disks.
   E. rigid cubes.
   F. I don't know.

11. If 2 pints of water at 40° F are mixed with a pint of water at 100° F, the temperature of the mixture immediately after mixing will be about

A. 40° F.
B. 50° F.
C. 60° F.
D. 80° F.
E. 100° F.
F. I don't know.

12. In terms of the theory of natural selection, what is the explanation of why giraffes have come to have such long necks?

A. Stretching to get food in high trees has made their necks longer.
B. There is something inside of giraffes which keeps making longer necks.
C. Giraffe food contained vitamins which caused the vertebrae to lengthen.
D. Giraffe necks have gotten longer and longer as time has gone on, but nobody has any idea why this is.
E. Giraffes born with the longest necks have been able to stay alive when food was scarce and have passed this trait on to their offspring.
F. I don't know.

13. For most chemical changes, which of the following most nearly describes what occurs?

A. Atoms are formed from energy.
B. Atoms are converted into energy.
C. Atoms are rearranged into new molecules.
D. Molecules are formed from energy.
E. Molecules are converted into energy.
F. I don't know.

14. Which of the following groups of animals and plants would be found in a desert community?

A. Ground hogs, deer, oak, fern
B. Grizzly bears, buffaloes, fir, grass
C. Ducks, herons, water lilies, cattails
D. Snakes, road runners, cactus, sagebrush
E. Starfish, sand dollars, kelp, plankton
F. I don't know.

15. If a person who is a light eater has a tendency to be overweight, it is most likely due to

A. too much exercise.
B. highly efficient utilization of food by the body.
C. a tendency toward nervousness.
D. an excessive dosage of vitamins.
E. a carefully balanced diet.
F. I don't know.

16. All of the following help to increase the total amount of food available to the human race EXCEPT

A. irrigating crops.
B. developing hybrids.
C. improving fertilizers.
D. outlawing the use of insecticides.
E. controlling the growth of undesirable plants.
F. I don't know.

17. Adding table salt to water results in the water's

A. changing into its elements.
B. freezing at a lower temperature.
C. evaporating faster.
D. dissolving more air.
E. becoming radioactive.
F. I don't know.

18. Any galaxy contains many

A. moons.
B. planets.
C. satellites.
D. stars.
E. winds.
F. I don't know.

19. A 5-pound rock is dropped from a cliff 500 feet high. The longer the rock falls, the greater is its

A. acceleration.
B. potential energy.
C. speed.
D. total energy.
E. volume.
F. I don't know.

20. A motor boat can travel 5 miles per hour on a still lake. If this boat travels downstream on a river that is flowing 5 miles per hour, how long will it take the boat to reach a bridge that is 10 miles downstream?

A. 15 min.
B. 30 min.
C. 45 min.
D. 60 min.
E. 75 min.
F. I don't know.

21. What carries sound to your ears from a radio or television receiver 15 feet away?

A. Electric currents
B. Molecules of air
C. Polarized waves
D. Radio waves
E. I don't know.

22. Which of these is characteristic of birds but of no other animals?

A. Ability to fly
B. Ability to lay eggs
C. Tendency to migrate
D. Body covering of feathers
E. Regulated body temperature
F. I don't know.

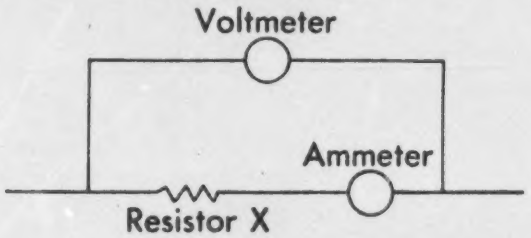
23. The purpose of a fuse in an electric circuit is

A. to increase the current in the circuit.
B. to increase the voltage across the circuit.
C. to decrease the resistance of the circuit.
D. to prevent possible damage to the circuit.
E. to raise the temperature of the wires in the circuit.
F. I don't know.

24. The musical note middle C is sounded on a violin string, and then C one octave higher is sounded on the same string. Which of the following is correct in comparing the two notes?

A. Both have the same frequency but different wavelengths.
B. Both have the same frequency but different amplitudes.
C. Middle C has a higher frequency and longer wavelength.
D. Upper C has a higher frequency and shorter wavelength.
E. I don't know.

25. In the section of the electric circuit shown below, the voltmeter registers 100 volts and the ammeter registers 20 amperes. If the connecting wires and the ammeter have negligible resistance, the resistance of resistor X is



A. 1 ohm.
B. 5 ohms.
C. 10 ohms.
D. 100 ohms.
E. 2,000 ohms.
F. I don't know.

26. Two light waves are traveling in a vacuum. The wave with the higher frequency will have the

A. higher speed.
B. lower speed.
C. longer wavelength.
D. shorter wavelength.
E. more nearly horizontal direction
F. I don't know.

27. Which of these has been used to obtain accurate estimates of the age of the oldest known rock strata?

A. Radiocarbon dating
B. Uranium-lead dating
C. Potassium-argon dating
D. Estimation of sedimentation rates
E. Correlation of age of fossils contained in the strata
F. I don't know.

28. What is the function of the placenta in a pregnant human female?

A. To push the baby out at birth
B. To keep the baby warm and moist
C. To carry nourishment to the baby
D. To cushion the baby against shocks
E. To keep the baby's body temperature constant
F. I don't know.

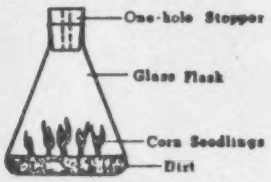
29. A particular cell is shaped like a cube. If all its linear dimensions were doubled, its volume would increase

A. 3 times.
B. 4 times.
C. 6 times.
D. 8 times.
E. 16 times.
F. I don't know.

30. On the average, in human females, the egg is released how many days after menstruation begins?

A. 2 days
B. 9 days
C. 14 days
D. 20 days
E. 24 days
F. I don't know.

31. Corn is planted in a flask as shown below. The flask is weighed each day for three weeks. The flask shows a daily weight loss. Which of the following is the best explanation of this loss of weight?



A. The original water evaporates within the first day.
B. Carbon dioxide is lighter in weight than ordinary air.
C. Seed material is changed to leaves and roots that weigh less.
D. The seedlings use starch in the seeds and give off gases that escape.
E. Dry air enters through the stopper and replaces the moist air in the flask.
F. I don't know.

32. In the equation below, which of the following elements are oxidized?

$SnS + 4HNO_3 \rightarrow S + SnO_2 + 4NO_2 + 2H_2O$

A. Tin and nitrogen
B. Tin and sulfur
C. Sulfur and oxygen
D. Oxygen and hydrogen
E. Nitrogen and oxygen
F. I don't know.

33. Experiments in which subatomic particles were shot at metal foil showed that atomic nuclei

A. rotate counterclockwise.
B. are electrically neutral.
C. are more dense than the rest of the atom.
D. vibrate to and fro in simple harmonic motion.
E. are nearly as large as the atoms that contain them.
F. I don't know.

34. The idea of natural selection is usually associated with the theory of evolution proposed by

A. Charles Darwin.
B. Edward Jenner.
C. Jean Lamarck.
D. Louis Pasteur.
E. Jonas Salk.
F. I don't know.

35. Skill in which of the following is most useful in scientific research?

A. Music
B. Magic
C. Marketing
D. Mathematics
E. Manufacturing
F. I don't know.

36. In a particular meadow there are many rabbits that eat the grass. There are also many hawks that eat the rabbits. Last year a disease broke out among the rabbits and a great number of them died. Which of the following probably then occurred?

A. The grass died and the hawk population decreased.
B. The grass died and the hawk population increased.
C. The grass grew taller and the hawk population decreased.
D. The grass grew taller and the hawk population increased.
E. Neither the grass nor the hawks were affected by the death of the rabbits.
F. I don't know.

37. A student made the following statement, "Some carbon atoms in the bread that I ate last night might have once been part of a dinosaur's body."
Which of the following is the best appraisal of the student's statement? This statement

A. contradicts the law of conservation of matter.
B. is ridiculous because dinosaurs lived so long ago.
C. could be true because atoms are rarely created or destroyed.
D. could be true only if the bread was grown in soil containing dinosaur fossils.
E. could not possibly be true because dinosaurs were animals but wheat is a plant.
F. I don't know.

38. Whenever scientists carefully measure any quantity many times, they expect that

A. all of the measurements will be exactly the same.
B. only two of the measurements will be exactly the same.
C. all but one of the measurements will be exactly the same.
D. most of the measurements will be close but not exactly the same.
E. I don't know.

39. Mercury can be enclosed in glass to make a thermometer because mercury

A. is a metal.
B. is more dense than glass.
C. conducts heat better than glass.
D. has a higher specific heat than glass.
E. expands more than glass when both are heated together.
F. I don't know.

40. Boyle's law, Charles' law, and Graham's law dealing with the behavior of gases can all be generalized in terms of which of the following?

A. Quantum theory
B. Recapitulation theory
C. Bohn theory of the atom
D. Kinetic-molecular theory
E. Theory of natural selection
F. I don't know.

41. Scientists can determine the age of certain rocks and their fossils by measuring

A. their specific gravities.
B. their crystalline structure.
C. the rate at which they have eroded.
D. the ratio of calcium to phosphorus in them.
E. the amounts of uranium and lead they contain.
F. I don't know.

42. If the cells referred to were all in the same organism, in which of the following is the amount of DNA present stated correctly?

A. It would be identical in mature egg and sperm cells.
B. It would be identical in sperm cells and liver cells.
C. It would be identical in a mature egg cell and a brain cell.
D. It would be half as much in a thyroid cell as in a liver cell.
E. It would be half as much in the fertilized egg as in a thyroid gland cell.
F. I don't know.

43. Metal cans for holding foodstuffs are chiefly made of

A. copper.
B. iron.
C. nickel.
D. tin.
E. I don't know.

44. Which of these is synthesized in the mitochondria, then later broken down in the nucleus and endoplasmic reticulum, with a resulting release of energy?

A. ATP
B. DNA
C. RNA
D. Lysosome
E. Golgi body
F. I don't know.

45. A horizontal wire extends in the north-south direction. When a compass is placed directly beneath the wire, the compass needle turns and points east. It would be most reasonable to infer that

A. electrons are flowing north in the wire.
B. electrons are flowing south in the wire.
C. the wire is magnetized.
D. the wire is positively charged.
E. the wire is negatively charged.
F. I don't know.

46. Which of the following is a theory rather than a fact or an opinion about platinum?

A. Platinum is a metal.
B. Mesons account for the stability of the nuclei of platinum atoms.
C. Platinum is the most beautiful metal.
D. Wedding bands should be made of platinum.
E. Platinum is more dense than water.
F. I don't know.

47. In each of five experiments, two objects were weighed four times each. Which experiment gives the strongest evidence that object I weighs more than object II?

	Object I	Object II
A. Experiment A	80 lb.	70 lb.
	81 lb.	69 lb.
	80 lb.	72 lb.
	82 lb.	70 lb.
B. Experiment B	69 lb.	82 lb.
	71 lb.	82 lb.
	70 lb.	80 lb.
	70 lb.	80 lb.
C. Experiment C	70 lb.	80 lb.
	75 lb.	75 lb.
	77 lb.	73 lb.
	80 lb.	70 lb.
D. Experiment D	80 lb.	70 lb.
	75 lb.	75 lb.
	73 lb.	77 lb.
	70 lb.	80 lb.
E. Experiment E	80 lb.	77 lb.
	79 lb.	76 lb.
	78 lb.	75 lb.
	77 lb.	74 lb.

F. I don't know.

48. United States scientists are ahead of scientists in other countries in every field of research.

A. I believe this statement.
B. I don't believe this statement.
C. I don't know.

49. Most scientists

A. want to know more about the world.
B. plan experiments as hastily as possible.
C. believe that some things happen without causes.
D. permit likes and dislikes to outweigh their observations.
E. use facts gathered by their own experiments and observations and pay no attention to results of others.
F. I don't know.

50. If you learn about a special television program dealing with a scientific topic, do you watch it?

A. Often
B. Sometimes
C. Never
D. I don't know.

APPENDIX B

PROJECT 70-1 QUESTIONNAIRE

PROJECT 70-01 Questionnaire

1. Teacher's name

2. School name

3. School Address _____(street)
_____(city)
_____)zip code)

4. Current occupation: (please circle where appropriate)
science teacher science department head
math teacher math department head
science supervisor math supervisor
administrator (please identify title) _____
other (please identify title) _____

5. Please list the teaching assignments by subject area(s) and grade level which you have had for the following years:
1970-71 _____ (grade) ___
1971-72 _____ (grade) ___
1972-73 _____ (grade) ___
1973-74 _____ (grade) ___
1974-75 _____ (grade) ___
1975-76 _____ (grade) ___

6. Please list the science or science education and/or math or math education graduate courses you have taken at institutions outside of Delaware during the following years:
1970-71 _____ (course names)
_____ (institutions)
1971-72 _____ (course names)
_____ (institutions)
1972-73 _____ (course names)
_____ (institutions)
1973-74 _____ (course names)
_____ (institutions)
1974-75 _____ (course names)
_____ (institutions)
1975-76 _____ (course names)
_____ (institutions)

7. Please list your advanced degree(s) and the institution(s) at which you completed those degrees:
degree _____ institution _____
degree _____ institution _____

8. If you have visited a Del Mod System Science/Math Resource Center in the past five years, please rate your opinion of the effectiveness of the following components of those Resource Centers: (Rate only those centers which you have visited.) (1 = highly negative; 7 = highly positive)

___ I have not visited the Del State Center

A. Delaware State College Science/Math Resource Center (Dover)

Science/Math Field Agent activities	1 2 3 4 5 6 7
Resource Center staff cooperation	1 2 3 4 5 6 7
Resource Center hours of business	1 2 3 4 5 6 7
Center Newsletters	1 2 3 4 5 6 7
Availability of curriculum materials	1 2 3 4 5 6 7
Quality of curriculum materials	1 2 3 4 5 6 7
Length of checkout period for materials	1 2 3 4 5 6 7

___ I have not visited the UD Center

B. University of Delaware Science/Math Resource Center (Newark)

Science/Math Field Agent activities	1 2 3 4 5 6 7
Resource center staff cooperation	1 2 3 4 5 6 7
Resource center hours of business	1 2 3 4 5 6 7
Availability of curriculum materials	1 2 3 4 5 6 7
Quality of curriculum materials	1 2 3 4 5 6 7
Length of checkout period for materials	1 2 3 4 5 6 7
Workshop quality at resource center	1 2 3 4 5 6 7

___ I have not visited the Georgetown Center

C. Delaware Technical and Community College Science/Math Resource Center (Georgetown)

Science/Math Field Agent activities	1 2 3 4 5 6 7
Resource Center staff cooperation	1 2 3 4 5 6 7
Resource Center hours of business	1 2 3 4 5 6 7
Center newsletters	1 2 3 4 5 6 7
Availability of curriculum materials	1 2 3 4 5 6 7
Quality of curriculum materials	1 2 3 4 5 6 7
Length of checkout period for materials	1 2 3 4 5 6 7
Workshop quality at Resource Center	1 2 3 4 5 6 7

9. If you have ever borrowed curriculum materials from a Science/Math Resource Center, did your school purchase those materials as a result of your having had them on hand for evaluation?
yes ___ no ___ does not apply ___ Why? _____
_____

10. If you have ever borrowed curriculum materials from a Science/Math Resource Center, did you decide not to purchase those materials after having them on hand for evaluation?
yes ___ no ___ does not apply ___ Why? _____
_____

11. Please indicate your opinion of the effect(s) the Del Mod System has had on your classroom activities in the past five years: (1 = little effect; 7 = great effect)

A. on improving your teaching skills	1 2 3 4 5 6 7
B. on making your courses more laboratory and investigative in orientation	1 2 3 4 5 6 7
C. on improving your awareness of new developments in science and/or math teaching	1 2 3 4 5 6 7
D. on improving your awareness of new science and/or math curriculum materials	1 2 3 4 5 6 7
E. on improving your awareness of educational resources in the State of Delaware (e.g., field trip sites, resource people, free materials published by state agencies, etc.)	1 2 3 4 5 6 7
F. on improving your communication with other science and/or math teachers in your system and elsewhere in the State of Delaware	1 2 3 4 5 6 7
G. on improving your awareness of activities and meetings via the Del Mod newsletters	1 2 3 4 5 6 7

12. Please rate the effectiveness of the following activities sponsored by the Del Mod System as they relate to your classroom situation: (1 = little effect; 7 = great effect)

A. Del Mod System workshops	1 2 3 4 5 6 7
B. Del Mod System/DPI graduate courses	1 2 3 4 5 6 7
C. Del Mod System conferences	1 2 3 4 5 6 7
D. Del Mod System field trips	1 2 3 4 5 6 7

13. What do most of your colleagues think about the Del Mod System and its activities over the past five years? (1 = very negative feelings; 7 = very positive feelings)

1 2 3 4 5 6 7

14. Did your science/math department participate in curriculum articulation activities as a direct or indirect result of the Del Mod System?

yes ___ no ___

If yes, at which grade level(s)? (Circle all grades that apply)

1 2 3 4 5 6 7 8 9 10 11 12

15. Did your science/math department participate in curriculum revision activities (guide development, objective writing, etc.) as a direct or indirect result of the Del Mod System?

yes ___ no ___

If yes, at which grade level(s)? (Circle all grades that apply)

1 2 3 4 5 6 7 8 9 10 11 12

16. If the Del Mod System funding were continued for the next few years, would you favor continuance of the following programs?

Science Field Agent	yes ___	no ___
Math Field Agent	yes ___	no ___
In-Service programs	yes ___	no ___
Teacher Mini-Grants	yes ___	no ___
Conferences	yes ___	no ___
Newsletters	yes ___	no ___
Science/Math Resource Centers	yes ___	no ___
Field trips	yes ___	no ___

17. Please comment briefly on what you feel the weak points of the Del Mod System have been over the past five years. Use the back of this sheet of paper if you need additional space for your comments.

18. Please comment briefly on what you feel the strong points of the Del Mod System have been over the past five years. Use the back of this sheet of paper if you need additional space for your comments.

19. Please comment briefly on how you would improve the Del Mod System if it were refunded for the next few years. What new programs would you like to see initiated? How could the Del Mod System more effectively serve your needs as a classroom teacher? Use the back of this sheet of paper if you need additional space for your comments.

20. After the Del Mod System funding runs out this summer, to whom or where will you go for assistance in improving your classroom instruction, keeping posted on meetings and activities, or keeping abreast of new developments in science or math education? Use the back of this sheet of paper if you need additional space for your comments.

APPENDIX C

PARTICIPANTS IN THE PROJECT 70-1

FOLLOW-UP STUDY

PROJECT 70-01 TEACHERS

TEACHER NAME	SCHOOL NAME	SCHOOL DISTRICT
Alcorn, Jerry	Caesar Rodney JHS	Caesar Rodney
Baker, Jack	Caesar Rodney JHS	Caesar Rodney
Banks, Dennis	Selbyville MS	Indian River
Barba, Roberta Hopkins	Martin J. Gauger MS	Newark
Blechman, Melvin	Milton JHS	Cape Henlopen
Bossard, Belasco	Dover High School	Capital
Boyd, Carl	Laurel Senior HS	Laurel
Budna, Joyce	Dover AFB HS	Caesar Rodney
Caccamise, George	Milford MS	Milford
Clark, Hunter, Jr.	Dover AFB HS	Caesar Rodney
Collier, Mary J.	Caesar Rodney JHS	Caesar Rodney
Culver, Howard	Delmar High School	Delmar
Curtis, Atwood	Dover Central MS	Capital
Darden, John T.	Seaford JHS	Seaford
Davis, Mark L.	Sussex County V.T.	Sussex County V.T.
Donofrio, Harriet	Smyrna MS	Smyrna
Gardner, Leon, Jr.	Del State Science/ Math Resource Center	Delaware State College
Gieske, Frank	Dover Central MS	Capital
Gladding, George	Wm. Henry MS	Capital
Gordon, Mitchell B.,Jr.	Dover Central MS	Capital
Hill, Allen	Dover Central MS	Capital
Hinzman, Dean	Caesar Rodney JHS	Caesar Rodney
Johnson, Alfred	Wm. Henry MS	Capital
Johnson, Robert	Sussex Central JHS	Indian River
Josephson, Charles	Wm. Henry MS	Capital
Kansak, Alexander	Selbyville MS	Indian River
Knaub, Russell	W.T. Chipman JHS	Lake Forest
Layton, Walter J.,Jr.	Wm. Henry MS	Capital
Long, James E.	Dover Central MS	Capital
Miller, Robert	Seaford JHS	Seaford
Milspaw, Thomas	Sussex Central JHS	Indian River
Nixon, Deloris W.	Dover Central MS	Capital
Peppard, Jean	Dover Central MS	Capital
Philips, William C.	Dover Central MS	Capital
Price, Verna	Dover Central MS	Capital
Rousak, Anthony J.	Rehoboth JHS	Cape Henlopen
Sirman, Laurence	Woodbridge JHS	Woodbridge
Statham, Flavous D.	Caesar Rodney SHS	Caesar Rodney
Stein, Charles	Milton JHS	Cape Henlopen
Stevenson, William	Wm. Henry MS	Capital
Swiggett, Edward	Redding MS	Appoquinimink
Wall, Roy	Woodbridge JHS	Woodbridge
Wethington, Ben C.	Milford MS	Milford
Wylie, Samuel	Woodbridge JHS	Woodbridge